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Application of Optical Diagnostics for Spray Characterization

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It is well known that spray characteristics are of vital importance to the fuel economy and emissions of modern day direct-injection engines. While extensive knowledge of the dilute downstream region in fuel sprays has been acquired over the years, much less is known of the dense near-tip region. It is in this region where the early stages of spray development occur, the consequences of which govern subsequent events and ultimately impact fuel economy and emissions. It has proved difficult to obtain quantitative measurements in this region because the extremely high optical densities result in excessive scattering. Lack of experimental data has left researchers with no option but to hypothesize about the characteristics of the region. Recently, the development and application of advanced diagnostics has provided new insight into the region. In particular, X-ray absorption measurements in the near-tip region have quantified fuel mass distribution at the nozzle exit. The findings of the work have resulted in a new understanding of the region that contradicts many previous beliefs. This presentation will discuss the application of various conventional and advanced optical diagnostics for spray characterization with special emphasis on the X-ray absorption technique.